*BY ORDER OF THE COMMANDER*
*EDWARDS AIR FORCE BASE*

*EDWARDS AIR FORCE BASE*
*INSTRUCTION 48-107*

*5 AUGUST 2014*

*Aerospace Medicine*

# *PREVENTION OF HEAT STRESS DISORDERS*

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**RELEASABILITY:** There are no releasability restrictions on this publication

OPR: 412 AMDS

Certified by: 412 MDG/CC
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Pages: 18

This instruction implements Air Force Policy Directive (AFPD) 48-1, *Aerospace Medicine Enterprise*, and Air Force Pamphlet (AFPAM) 48-151, *Thermal Injury*. It establishes Edwards Air Force Base (EAFB) responsibilities and procedures to prevent the adverse health effects of heat stress. This instruction applies to all personnel who are assigned to Edwards AFB with the exception of contractor personnel. The provisions of this instruction (i.e., work/rest cycles) apply to workers exposed to hot/cold environments. This publication may be supplemented at any level, but all direct Supplements must be routed to the OPR of this publication for coordination prior to certification and approval. During mission essential, contingency, or emergency operations, commanders may waive the provisions of this instruction; however, in that event, they must ensure all supervisors exercise caution, make certain all subordinate personnel are aware of heat injury symptoms, and take the necessary actions to protect the health of their personnel. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with (IAW) Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW Air Force Records Information Management System (AFRIMS) Records Disposition Schedule (RDS). Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Form 847s from the field through the appropriate functional's chain of command. This instruction requires collecting and maintaining information protected by the Privacy Act of 1974 (5 U.S.C. 552A) and AFI 33-332, *Privacy Act Program.*

## 1. Roles and Responsibilities:

### 1.1. 412 AMDS/SGPB Bioenvironmental Engineering Flight will:

1.1.1. Be the OPR concerning the thermal stress program for the installation.

1.1.2. Use the WBGT to measure the heat stress potential throughout the summer months. Each time the Heat Stress Condition changes, a new Heat Stress Advisory will be issued IAW paragraph **3.1**.

1.1.3. Upon request, during non-routine activities (i.e., change of command ceremonies, parades, and readiness exercises) 412 AMDS/SGPB will monitor localized WBGT at site of non-routine activities and determine the Heat Stress Condition.

1.1.4. Ensure thermal stress readings and guidance are available 8 hours a day during the duty week by posting the most current WBGT index on the Edwards Air Force Base SharePoint Thermal Stress Updates link (**https://org.eis.afmc.af.mil/sites/95mdg/amds/Heat%20Index%20Documents/WBGTDescription.aspx**) accessible by all base personnel via EAFB Portal.

1.1.5. Call the 412th Test Wing Command Post (412 TW/CP) at 527-3040 with the current WBGT reading and thermals stress condition so they can prepare and forward advisory messages to the entire base.

1.1.6. Ensure all work centers that are affected by thermal stress include training in their job safety training outline.

1.1.7. Investigate all thermal stress illnesses documented on AF IMT 190, *Occupational Illness/Injury Report.*

1.1.8. Develop an office operating instruction detailing procedures for determining WBGT measurements and heat/cold stress conditions.

1.1.9. During normal duty hours, all related questions/concerns will be directed to 412 AMDS/SGPB. After duty hours, emergency thermal stress items will be directed to the 412 AMDS/SGPB technician on-call via the 412 TW/CP at 527-3040

1.2. **412 AMDS/SGPM Public Health Flight will:**

1.2.1. Assist in investigating heat illness incidents.

1.2.2. Coordinate with Edwards AFB staff personnel on discrepancies disclosed during investigation of heat stress illness incidents or other pertinent findings.

1.3. 412 TW/CP Command Post will:

1.3.1. Phone 412th Maintenance Operations Squadron Maintenance Operations Center (412 MOS/MXOO) and 412th Test Wing Civil Engineering (412 TW/CE) to inform them of thermal stress advisories upon notification by 412 AMDS/SGPB of Stage 2, 3, 4 and 5 Heat Stress Condition categories change.

1.3.2. Send pop-up alert notification, once informed by 412 AMDS/SGPB, to the entire base when the Heat Stress Condition categories change to Stage 3, 4 and 5. Heat stress messages will include the current Heat Stress Condition and upon acknowledgement of pop-up alert notification; base personnel will be directed to the Edwards Air Force Base SharePoint Thermal Stress Updates link (**https://org.eis.afmc.af.mil/sites/95mdg/amds/Heat%20Index%20Documents/WBGTDescription.aspx**) accessible by all base personnel via EAFB Portal.

1.4. **412 OSS/OSW Weather Flight will:**

1.4.1. Measure and collect temperature, wind speed information and dew point readings and update the current weather information on their website.

1.4.2. Inform flight test squadrons of the Fighter Index of Thermal Stress (FITS) condition (see paragraph 4).

1.4.3. Maintain an automated heat stress forecast including an estimated WBGT Index with flag conditions and forecasted FITS values under the Edwards AFB Automated Heat Stress Forecast link, (**https://bsx.edwards.af.mil/weather/index.html**).

1.5. **Organizational and Unit Commanders will:**

1.5.1. Enforce activity levels for personnel in day-to-day operations and training status.

1.5.2. Ensure workers and trainees are properly acclimatized to heat exposures (see paragraph 2).

1.5.3. Brief supervisors and workers annually on the health hazards of heat stress, the WBGT index, notification procedures, flag colors (if used), and appropriate preventive

measures. This training will be documented on AF Form 55, Employee Safety and Health Record. Ensure training is documented in an appropriate manner for individual organizations (i.e., CAMS for maintenance personnel). Supervisors must ensure the AF 55 is marked FOUO IAW DoD 5200.1-R if it has a SSN on it. Further, if the forms with a SSN are maintained in a binder, they need to be properly safeguarded IAW DoD 5200.1-R.

1.5.4. Where applicable, ensure flying personnel are annually informed on how heat stress affects aircrew performance, the Fighter Index of Thermal Stress (FITS) temperature and zones, and appropriate preventive measures.

1.5.5. During training exercises when personnel wear the ground crew chemical defense ensemble, ensure supervisors and workers are counseled concerning the early signs of heat stress and methods to be used to minimize the effects of heat stress.

1.5.6. Plan work/rest cycles for personnel exposed to hot environments.

1.5.7. Disseminate the WBGT index to workers and trainees.

1.5.8. Ensure exposed workers and trainees increase their fluid intake as stated in **Table 7.1**. Be aware that feelings of weakness and/or fatigue may be symptoms of hyponatremia (low blood sodium level, which may be caused by overconsumption of water).

**2. Acclimatization:**

2.1. Acclimatization is a series of physiological adjustments that occur when an individual is exposed to a hot climate. A period of acclimatization is required for all personnel regardless of physical condition. Generally, fitter individuals acclimatize quicker. Acclimatization is achieved by exposing individuals progressively to increasing levels of heat and physical exertion. Acclimatization to heat begins with the first exposure. Typically, 50 percent is reached by the end of the first week. Substantial acclimatization (about 80 percent) can be expected by the end of the second week.

2.2. The following personnel require acclimatization:

2.2.1. Individuals who are routinely and occupationally exposed to strenuous work in hot environments. This may occur as outside temperatures increase during the spring and summer.

2.2.2. Newly assigned personnel arriving from a cooler climate should follow the acclimatization guidelines described in paragraph 2.3.

2.2.3. Personnel returning to work after four or more days of illness should undergo an abbreviated acclimatization work schedule.

2.3. Initially, perform the most strenuous tasks early in the morning or late in the evening to conform to ambient temperature. As workers become acclimatized, work schedules can be shifted back to normal routines. When non-acclimatized workers are exposed to heat, they may experience some discomfort and signs of heat strain; such as high body temperatures, increased heart rates, and fatigue. As acclimatization progresses, the ability to perform at the same level of heat stress improves and symptoms of discomfort and strain diminish. During the two-week acclimatization period, ensure workers are aware of the signs and symptoms of

heat stress disorders and drink sufficient water (see **Table 7.1** for guidelines). When discomfort and heat stress symptoms occur, workers should self-pace their activities to perform below their maximum physical capacity by adjusting their work speed and taking brief, unscheduled, in-place breaks. After a period of one to two weeks, a worker should be able to perform all tasks without difficulty (dependent on the temperature and workload).

**3. Procedures:**

3.1. Heat Stress:

3.1.1. 412 AMDS/SGPB will monitor the heat stress index daily during the summer months. The summer monitoring period will begin around Memorial Day and end around Labor Day. (The summer monitoring period may be increased or decreased based on seasonal variations.)

3.1.2. When the ambient temperature reaches 95$^{o}$F, 412 AMDS/SGPB will perform heat stress monitoring every 2 hours during normal duty hours from 0800 until 1600, except as noted in Paragraphs 3.1.3 and 3.1.8. See **Attachment 4** for additional information.

3.1.3. When the WBGT Index reaches 85$^{o}$F, 412 AMDS/SGPB will initiate heat stress monitoring hourly during normal duty hours, except as noted in Paragraph 3.1.8.

3.1.4. Heat Stress Advisories will be disseminated every time the WBGT Index changes IAW with **Table 3.1**.

3.1.5. 412 AMDS/SGPB will notify the 412 TW/CP by phone at 527-3040 to issue a Heat Stress Advisory.

3.1.6. 412 TW/CP will phone 412 MOS/MXOO and 412 TW/CE to inform them of thermal stress advisories upon notification by 412 AMDS/SGPB of Stage 2, 3, 4 and 5 Heat Stress Condition categories changes and send pop-up alert notifications to the entire base when the Heat Stress Condition categories change to Stage 3, 4 and 5.

3.1.7. 412 AMDS/SGPB will update the heat stress condition listed on the EAFB SharePoint Thermal Stress Update link at (**https://org.eis.afmc.af.mil/sites/95mdg/amds/Heat%20Index%20Documents/WBGTDescription.aspx**).

3.1.8. If Stage 2 heat stress conditions exist at the end of the duty day (1600L), shop supervisors will be required to monitor ambient temperature levels, either through thermometers located in the shop, by contacting the base weather station at 661-277-4472, or through the estimated WBGT index located at the Edwards AFB Automated Heat Stress Forecast link, (**https://bsx.edwards.af.mil/weather/index.html**). When the ambient temperature drops below 95 F, the supervisor will eliminate any work/rest cycles currently in effect. If Stage 3 heat stress conditions or higher exists at the end of the duty day, 412 AMDS/SGPB will continue hourly monitoring until Stage 2 heat stress conditions are reached; at that time, 412 AMDS/SGPB will follow procedures as noted in Paragraphs 3.1.4-3.1.8.

3.1.9. Guidelines for Occupational Heat Exposures

3.1.9.1. Personnel who routinely perform their jobs in hot environments (such as aircraft maintenance, grounds maintenance, and repair work in steam pits and tunnels) are considered occupationally exposed.

3.1.9.2. Supervisors of occupationally exposed personnel should use **Tables 1** and **3** to plan work/rest cycles for individuals under their control. When the WBGT index reaches the temperatures shown in the table, supervisors will initiate the appropriate work/rest cycle.

3.1.9.3. Exposures above 90F WBGT should be allowed only when performing mission essential duties, and then only with caution.

3.1.9.4. When necessary to accomplish the task, two or more details should be arranged to work in sequence to ensure each crew adheres to the proper work/rest cycle.

3.1.9.5. Heat Stress Conditions provide guidance to workplace supervisors in order to reduce heat stress injuries. The WBGT Index should not be used directly for operations requiring heavy personal protective equipment (PPE) or hot indoor operations. Use correction factors for PPE from **Table 7.1**.

**Table 1. WBGT Stages, Temperature Ranges and Flag Colors**

| Stage | Temperature Range (WBGT) | Flag Color |
|---|---|---|
| 1 | 78.0 – 81.9 °F | (No flag required) |
| 2 | 82.0 – 84.9 °F | Green |
| 3 | 85.0 – 87.9 °F | Yellow |
| 4 | 88.0 – 89.9 °F | Red |
| 5 | 90 °F and above | Black |

**4. Guidelines for Flying Personnel:** All aircrew must understand and comply with the following guidance:

4.1. General. The FITS Table (see **Attachment 2**) will be used to determine Normal, Caution, and Danger Zones. Forecasted FITS values can be found on the Edwards AFB weather homepage (**https://bsx.edwards.af.mil/weather/index.html**) under the Range Forecast and/or Edwards Automated Heat Stress Forecast links. 412 OSS/OSW will forecast the FITS values for the day and include it in the Range Mission Execution Forecast. The 412 OSS/OSW will determine the current FITS Zone on an hourly basis during normal duty hours Monday through Friday. If the Caution or Danger Zones are entered, they will disseminate a FITS Weather Advisory over the Joint Environmental Toolkit (JET) and notify the Supervisors of Flying (SOF), who will ensure it is included on the Automated Terminal Information System. Unit Operations Desks will clearly post the FITS Zone. 412 OG/CC is the waiver authority for this guidance.

4.2. Hot Weather Precautions for all Aircrew

4.2.1. All aircrew will allow time for acclimatization to hot weather and should avoid extreme efforts on the first several days of exposure.

4.2.2. When exposed to hot weather, aircrew will drink more water than thirst dictates; at a minimum the amounts recommended in Table 7.1. This will ensure proper hydration as the body increases sweat secretion to defend against heat. Aircrew should either carry water or have it readily available in the aircraft.

4.2.3. Flying squadron commanders will ensure their pilots understand the FITS measurement system and the appropriate preventive measures. 412 AMDS/SGPB can assist.

4.3. Fighter/Trainer Aircrew Procedures. This section applies to aircrew flying high-G aircraft (i.e., capable of G-loading in excess of 4.0 G).

4.3.1. Caution Zone (CZ) Procedures: Limit ground operations outside of an air-conditioned environment to 90 minutes maximum. If ground operations exceed 90 minutes (i.e. no flight), the aircrew must spend 60 minutes in an air-conditioned environment and re-hydrate before re-attempting flight. Once a flight is completed, the aircrew must spend at least 60 minutes in an air-conditioned environment and re-hydrate before flying again.

4.3.2. Danger Zone (DZ) Procedures: Cancel all flights planned to remain below 3,000 feet AGL (low-level/pattern-only sorties). Limit ground operations outside of an air-conditioned environment to 45 minutes maximum. T-38s are considered non-air-conditioned aircraft while on the ground and must take off within the 45-minute limit. If ground operations exceed 45 minutes (i.e., no flight), the aircrew must spend 60 minutes in an air-conditioned environment and re-hydrate before attempting to fly. Once a flight is completed, the aircrew must spend at least 60 minutes in an air-conditioned environment and re-hydrate before flying again. Do not fly with chemical defense, immersion, or arctic flight equipment while in the DZ.

4.3.3. Cancellation: Cancel all non-essential flights when the FITS value exceeds 115 °F.

4.4. Multiengine Jet, Reciprocating, Turboprop, and Helicopter Aircrew Procedures. Aircrew flying non-fighter/trainer aircraft will observe the following precautions when Edwards AFB is in the FITS Caution or Danger Zones.

4.4.1. If available, use cooling air during ground operations.

4.4.2. Limit ground operations outside of an air-conditioned environment to no more than three hours. If the 3-hr limit is exceeded, aircrew must spend 30 minutes in an air-conditioned environment and re-hydrate before flying. The aircraft commander may waive the 3-hr limit based on mission requirements.

**5. Guidelines for Personnel Wearing the Ground Crew Chemical Defense Ensemble:**

5.1. Personnel performing ground crew operations and training while wearing the charcoal-impregnated over-garment and associated protective equipment of the chemical defense ensemble are at increased risk of injury from heat stress. Maximum work times tolerated by personnel while they are wearing the protective ensemble are affected by multiple individual factors, such as an individual's physical condition, state of thermal acclimatization, degree of hydration, the workload associated with a given task, and environmental factors, including

air velocity, radiant heat (sunlight), air temperature, and humidity. WBGT criteria include many of these variables.

5.2. AFMAN 32-4005, *Personnel Protection and Attack Actions*, contains measures to minimize heat casualties in personnel while they are accomplishing their mission. Estimates of increases in task performance times and maximum and safe work times while personnel are wearing MOPP 3 and 4 equipment are shown in Table 5.1. Commanders and supervisors should use this information when planning and conducting exercises to avoid heat injuries in their personnel.

**Table 2. Heat Stress Workload Task Multiplier for MOPP 3 and 4 Conditions**

| | | **AMBIENT TEMPERATURE** | | |
|---|---|---|---|---|
| **WORK RATE** | **ACTIVITY EXAMPLES** | **20 to 49 °F -7 to 9 °C** | **50 to 84 °F 10 to 28 °C** | **85 to 100 °F 29 to 38 °C** |
| **LIGHT** | Tower Operators<br>Operations Officers<br>Pilot Ground Activities<br>Command Post Activities | 1.2 | 1.4 | 1.5 |
| **MODERATE** | Refueling<br>Avionics Shop<br>Aircraft Maintenance<br>NBC Recon Team | 1.3 | 1.4 | 3.0 |
| **HEAVY** | Armament Crew<br>Rapid Runway Repair<br>Heavy Aircraft Repair | 1.7 | 2.1 | 5.0 |

To estimate how much time it will take to perform a task or operation while in MOPPs 3 and 4:

1. Determine the appropriate column for the outside temperature.
2. Find the work rate using the activity examples as a guide (e.g. light, moderate, and heavy).
3. Find the task time multiplier: read across the work rate line and down the temperature column.

**Example:** A rapid runway repair team is working while the outside temperature is 60 °F. The task normally takes 2.5 hours to complete. By using the chart, rapid runway repair is listed as a heavy work rate under the activity examples. Also, by using the outside temperature (60 °F) for that work rate (heavy), find the task time multiplier. In this case, the task time multiplier is 2.1. Take the task time multiplier and multiply it by the time it normally takes to do the job (2.1 x 2.5 hours = 5.25 hours). Therefore, the time it takes to do the job in MOPP 3 or 4 is 5.25 hours.

5.3. During exercises where MOPP gear is worn, 412 AMDS/SGPB will notify the Deployment Control Center and Command Post (CP) of the current work/rest ratios and the CP will then relay that information to the Installation Control Center. 412 AMDS/SGPB personnel will monitor the heat stress until two consecutive WBGT Index readings fall below 74.9 °F.

**6. Guidelines for Personnel Working Under Aircraft Shelters:** See Attachment 3 for considerations applied to personnel working on the flight line under the shade of aircraft shelters.

**7. Prevention of Heat Stress Disorders:** The following subjects discuss actions to help prevent heat stress disorders.

7.1. Education. Personnel working and/or training in hot environments must be educated on the causes, symptoms, first-aid treatment, and prevention of heat disorders. The 412 AMDS Aerospace and Operational Physiology Team (AOPT) can assist unit commanders with heat stress education. Shop supervisors will also include heat-stress awareness in annual safety training, where applicable.

7.2. Water. Drink large quantities of cool water to make up for water lost through sweating. It is better to drink small amounts of water frequently to replace water than to drink large amounts less frequently.

7.2.1. Milk and coffee do not effectively replace water loss. Consumption of these fluids should be kept to a minimum.

7.2.2. Carbonated beverages, while containing water, are not as effective as water in keeping the body hydrated because of the tendency to delay gastric emptying.

7.3. Salt. Some salt is lost in sweat. Because the typical North American diet contains so much salt, an individual should season food to taste but should not make any additional attempts to add excessive salt to the diet. Salt tablets will not be used except when ordered by a competent medical authority.

7.4. Acclimatization. Personnel must be acclimated to heat exposures. See paragraph 2.1.

7.5. Work Schedules. Modify work schedules to perform the heaviest work during the coolest parts of the day. When working in hot environments, establish work and rest cycles as outlined in Table 7.1. Take rest breaks in cool, shaded areas.

**Table 3. Work Rest Cycles and Fluid Replacement Guidelines**

| WBGT[1] Index (°F) | Light (Easy) Work | | Moderate Work | | Hard (Heavy) Work | |
|---|---|---|---|---|---|---|
| | Work/ Rest [2] | Water Intake [3] (Qt/Hour) | Work/ Rest [2] | Water Intake [3] (Qt/Hour) | Work/ Rest [2] | Water Intake [3] (Qt/Hour) |
| 78 - 81.9 | NL [4] | 1/2 | NL | 3/4 | 40/20 min | 3/4 |
| 82 - 84.9 | NL | 1/2 | 50/10 min | 3/4 | 30/30 min | 1 |
| 85 - 87.9 | NL | 3/4 | 40/20 min | 3/4 | 30/30 min | 1 |
| 88 - 89.9 | NL | 3/4 | 30/30 min | 3/4 | 20/40 min | 1 |
| >90 | 50/10 min | 1 | 20/40 min | 1 | 10/50 min | 1 |

Notes:
1. If wearing any MOPP gear, add 10 °F to Wet Bulb Globe Temperature (WBGT). If wearing personal body armor in humid climates; add 5 °F to WBGT.
2. Rest means minimal physical activity (sitting or standing), accomplished in shade, if possible.
3. *Caution:* Daily fluid intake should not exceed 12 quarts. Hourly fluid intake should not exceed 1 quart. The work/rest time and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified work category. Individual water needs will vary = 1/4 quart hour.
4. NL = no limit to work time per hour.

**Work Intensities of Military Tasks**

| Light (Easy) Work | Moderate Work | Heavy (Hard) Work |
|---|---|---|
| - Weapons maintenance<br>- Walking on hard surface at 2.5 mph, with <30 pound load<br>- Marksmanship training<br>- Tower operations<br>- Operations NCOs/officers<br>- Pilot ground activities<br>- Command post and unit control center activities | - Walking on loose sand at 2.5 mph, with no load<br>- Walking on hard surface at 3.5 mph <40 pound load<br>- Calisthenics<br>- Patrolling<br>- Individual movement techniques such as low/high crawl<br>- Refueling<br>- Avionics shop<br>- Aircraft maintenance<br>- Unit post attack reconnaissance | - Walking on hard surface at 3.5 mph, with >40 pound load<br>- Walking on loose sand at 2.5 mph, with any load<br>- Armament crew<br>- Heavy aircraft repair<br>- Specialized teams such as NBC reconnaissance, search and recovery, rapid runway repair, CCA, fire protection, decontamination, medical, damage assessment and repair, and EOD |

7.6. Food. Avoid eating greasy, fatty, or heavy foods if possible.

7.7. Medical Treatment. Seek medical treatment for any heat stress-related problems, including rashes.

7.8. Medications. Any individual who works outdoors or in hot environments should inform their doctor when receiving medications. Many prescription drugs have diuretic effects or may reduce the body's ability to sweat. These reactions can have severe effects when working outdoors and may speed the heat-stress process significantly.

7.9. Heat syncope is a heat-stress condition caused by pooling of the blood in dilated vessels and lower extremities brought on by prolonged periods of immobile activity or standing. Selecting acclimated personnel to participate in parades and ceremonies, having them drink copious amounts of water prior to ceremony, and directing them to discreetly move arms and legs to assist the return of blood to the heart may prevent heat syncope.

**8. Recognition and First-Aid Treatment for Heat Stress Disorders:** Use Table 8.1. as a guide in recognizing the common heat stress disorders and as a quick reference for first aid.

**Table 4. Symptoms and First-Aid Treatment for Heat Injuries**

| **Injury** | **Symptoms** | **First Aid** |
|---|---|---|
| Heat Syncope | Fainting with prolonged standing in the heat | Remove to cool area. Allow to recline and provide cool water. Recovery will be prompt and complete. |
| Heat Cramps | Active sweating, muscle cramps | Cramped muscles should be stretched or massaged. |
| Heat Exhaustion | Profuse sweating, headache, weakness, and nausea; skin cool and moist | Remove to cool area. Allow casualty to rest in shade or cool area. Provide sips of water. If symptoms do not improve in 15-30 minutes, transport to medical facility. |
| Heat Stroke (MEDICAL EMERGENCY) | High body temperature; skin dry and hot; unconsciousness, convulsions, or delirium | THIS IS A MEDICAL EMERGENCY. Call 911/local number first. Lay person down in shade or cool area with feet elevated, until help arrives. Give sips of water if casualty is conscious. If skin is hot and dry to touch, remove clothing; pour water over person and fan. If casualty beings shivering stop fanning process. Continue cooling measures during transportation. |
| **NOTE:** Referenced from AFPAM 10-100 and AFPAM 48-151. | | |

MICHAEL T. BREWER, Brigadier General, USAF
Commander

## Attachment 1

## GLOSSARY OF REFERENCES, AND SUPPORTING INFORMATION

***References***

AFPD 48-1, Aerospace *Medicine Enterprise,* 23 August 2011

AFPAM 48-151, *Thermal Injury*, 18 November 2002

AFPAM 10-100, *Airman's Manual,* 1 March 2009

SAM TR-78-6, USAFSAM/VNT, *Fighter Index of Thermal Stress: Development of Interim Guidance for Hot Weather USAF Operations,* February 1978

***Adopted Forms***

AF Form 55, *Employee Safety and Health Record*

***Abbreviations and Acronyms***

**412 AMDS**—412th Aerospace Medicine Squadron

**EAFB**—Edwards Air Force Base

**412 AMDS/SGPB**—412th Aerospace Medical Squadron Bioenvironmental Engineering

**412 OSS/OSW**—412th Operation Support Squadron Weather Flight

**412 TW/CP**—Test Wing Command Post

**412 AMDS/SGPM**—412th Aerospace Medical Squadron Public Health

**412 MOS/MXOO**—412th Maintenance Operations Squadron Maintenance Operations Center

**CZ**—Caution Zone

**DZ**—Danger Zone

**F/C**—degrees Fahrenheit/Celsius

**FITS**—Fighter Index of Thermal Stress

**SOF**—Supervisor of Flying

**WBGT**—Wet Bulb Globe Temperature

**HAWC**—Health and Wellness Center

***Terms***

**Acclimatization**—A period of adjustment an individual's body requires to become accustomed to working in hot environments. Full acclimatization occurs through progressive degrees of heat exposure and physical exertion. Personnel may need two weeks of increasing exposures to become substantially acclimated and may retain most of their adaptation for about one week after leaving a hot climate. Workers in good physical condition acclimatize more quickly.

**Air-Conditioned Environment**—1) Any air-conditioned building or vehicle; 2) The air-conditioned cockpit or cabin area of an aircraft, with cooling air supplied either externally or internally.

**Curtailment vs. Suspension of Activities**—Curtailment means reducing the level of exertion, reducing the pace of the activity and increasing the number and length of the rest periods. Suspension means to stop all strenuous activities temporarily until favorable environmental conditions return.

**Diuretic**—Diuretic compounds cause your body to lose excess water through saliva, urination, or excessive sweating. Examples of diuretics are caffeine-containing drinks such as coffee and sodas, alcohol, and water loss pills. Some prescription medications contain diuretic compounds.

**Heat Stress**—Heat stress is the combination of environmental and physical work factors that constitute the total heat load imposed on the body. The environmental heat stress factors are air temperature, radiant heat exchange (example, sunlight), air movement, and relative humidity. Physical work contributes to total heat stress through the body's production of heat (metabolic heat) as it burns energy to sustain the work. This production of metabolic heat depends on the intensity of the physical effort that is affected, in turn, by body size, muscular development, physical fitness, and age.

**Fighter Index of Thermal Stress (FITS)**—A guideline to predict cockpit environmental conditions during low-level missions which may jeopardize aircrew performance. FITS is based on the dry air and the dew point temperatures.

**Heat Stress Disorders**—Heat stress disorders are general terms used to indicate any type of adverse health problem related to heat. Heat syncope, cramps, exhaustion, and strokes are all forms of heat stress disorders. Heat stress disorders may be recognized by one or more of the following symptoms: nausea, vomiting, fever, dizziness, headache, faintness, abdominal or leg cramps, abnormal sweating, lack of coordination, mental confusion, and convulsions. The personnel most likely to be affected by the heat are those who have just arrived from cooler regions of the country, are obese, or are in poor condition.

**Heat Syncope**—Fainting while standing erect and immobile in heat, caused by pooling of the blood in dilated vessels and the lower parts of the body.

**Heat Cramps**—Painful intermittent spasms of the muscles used during work (arms, legs, or abdominal) which may occur during or after work hours. Cramps may result from exposure to high temperature for a relatively long time, particularly if accompanied by hard physical work. Cramps usually occur in unacclimated personnel after heavy sweating and are the result of excessive loss of salt from the body. Even if the moisture is replaced by drinking water, the loss of salt by sweating may provoke heat cramps.

**Heat Exhaustion**—The signs of heat exhaustion are profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and clammy with sweat; however, the body temperature rises rapidly.

**Heat Stroke**—Increased body temperature, if uncontrolled, may lead to delirium, convulsions, coma, and even death. Heat stroke is a much more serious condition than either heat cramps or heat exhaustion.

**Hyponatremia**—Low sodium level in the blood, a condition caused by the over consumption of water. Symptoms include feeling weak and fatigued, which may progressively get worse as the sodium level declines. In severe cases, patients may experience seizures and loss of consciousness.

**Rest**—Minimal physical activity, and should be accomplished in the shade, if possible. Any activity requiring only minimal physical activity can be performed during "rest." Examples are classroom type training, paperwork, minor maintenance on vehicles or weapons, and personal hygiene activities.

**Sortie**—One sortie equates to stepping from Ops, going to the jet, flying, and returning to Ops (Ops-jet-fly-Ops).

**Timing**—Begins when exiting air-conditioned environment (ops, life support, step van with air-conditioning). Time is cumulative on the flight line while outside air-conditioned aircraft.

**Wet Bulb Globe Temperature (WBGT) Index**—The WBGT index is a combination of temperature measurements which considers dry air temperature, relative humidity, and radiant heating. The equation for the WBGT index uses dry bulb, natural wet bulb, and black globe temperatures.

***Mandatory, Preferred, and Acceptable Requirements***

**May** - Indicates an acceptable or satisfactory method of accomplishment.

**Should**— Indicates a preferred method of accomplishment.

**Will**— Indicates a mandatory requirement and is also used to express a declaration of intent, probability, or determination.

## Attachment 2

## FIGHTER INDEX OF THERMAL STRESS (FITS) CHART

**A2.1. FITS for Flying Personnel.** See Paragraph 4.

**A2.2. FITS Zone and FITS Value.** Enter with local dry bulb (DB) temperature and dew point temperature. At intersection, read the FITS zone and the FITS value in F.

**Table A2.1. Fighter Index of Thermal Stress (FITS) Reference Values**

| Dry Bulb Temperature (°F) \ Dew point Temperature (°F) | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | >110 |
|---|---|---|---|---|---|---|---|---|---|
| 70 | 70 | 73 | 76 | 81 | 86 | | | | |
| 75 | 74 | 77 | 80 | 84 | 89 | | | | |
| 80 | 77 | 80 | 83 | 87 | 92 | 98 | | Above Saturation | |
| 85 | 81 | 83 | 86 | 90 | 95 | 101 | | Temperature | |
| 90 | 84 | 87 | 90 | 93 | 98 | 104 | 110 | | |
| 95 | 88 | 90 | 93 | 96 | 101 | 108 | 112 | | |
| 100 | 91 | 93 | 96 | 99 | 104 | 109 | 115 | 122 | |
| 105 | 94 | 96 | 99 | 102 | 107 | 112 | 118 | 124 | |
| 110 | 97 | 99 | 102 | 105 | 109 | 114 | 120 | 126 | 133 |
| 115 | 100 | 102 | 105 | 109 | 112 | 117 | 123 | 129 | 136 |
| 120 | 104 | 105 | 108 | 111 | 115 | 120 | 125 | 131 | 138 |

**LEGEND**

| | |
|---|---|
| Normal Zone | |
| Caution Zone | |
| Danger Zone | |

**A2.3. Notes For Fighter/Trainer Aircrew:**

A2.3.1. Caution Zone

A2.3.1.1. Be aware of heat stress.

A2.3.1.2. Limit ground operations outside an air-conditioned environment to 90 minutes maximum.

A2.3.1.3. Minimum of 60 minutes recovery time in an air-conditioned environment between sorties/sortie attempts.

A2.3.2. Danger Zone:

A2.3.2.1. Cancel low-level flights/pattern-only sorties (below 3000 ft AGL).

A2.3.2.2. Limit ground operations outside an air-conditioned environment to 45 minutes maximum.

A2.3.2.3. Minimum of 60 minutes recovery time in an air-conditioned environment between sorties/sortie attempts.

A2.3.3. Cancellation: When FITS value is greater than 115 °F, cancel all nonessential flights.

**A2.4. Notes For Non-Fighter/Trainer Aircrew:**

A2.4.1. Caution/Danger Zone:

A2.4.1.1. Use cooling air during ground operations if available

A2.4.1.2. Limit ground operations outside an air-conditioned environment to 3 hours maximum (A/C may waive)

A2.4.1.3. Minimum of 30 minutes recovery in an air-conditioned environment if 3 hour limit is exceeded.

## Attachment 3

## HEAT STRESS GUIDELINES FOR AIRCRAFT SHELTER WORK

**Figure A3.1. Recommended Heat Stress Index for AC Shelters on Flight Line**

**DEPARTMENT OF THE AIR FORCE**
**HEADQUARTERS 412TH TEST WING (AFMC)**
**EDWARDS AIR FORCE BASE, CALIFORNIA**

23 August 11

MEMORANDUM FOR RECORD

SUBJECT: Recommended Heat Stress Index for AC Shelters on Flight Line

FROM: 412 AMDS/SGPB
55 N. Wolfe Ave.
Edwards AFB, CA 93524-1132

1. Bioenvironmental Engineering Flight (BEF; 412 AMDS/SGPB) conducted a three-day WBGT (wet-bulb globe temperature) heat stress survey under the AC shelters on Ramp 7 (between Bldg. 1630 and Bldg. 1635) in July 2007. The results obtained from the assessments on 12, 17, and 26 July 2007 indicate that significant relief is provided by the shelters. The WBGT under the shade of the shelters is between 2-8°F lower than the WBGT in the sun and usually between 4-5°F.

2. BEF recommends that Commanders and supervisors follow the WBGT Level (Flag Stage) that is **one** level lower than the level posted on the Edwards Heat Stress Update Sharepoint **until** we reach Stage 5 (Black Flag), during which BEF recommends all outdoor work be limited to critical missions only. A reminder of the Levels and Flags is in the below table.

| Stage | WBGT Index (°F) | Flag | Work/Rest Cycle |
|---|---|---|---|
| 1 | 78-81.9 | None (White) | NL |
| 2 | 92-84.9 | Green | 50/10 min |
| 3 | 85-87.9 | Yellow | 40/20 min |
| 4 | 88-89.9 | Red | 30/30 min |
| 5 | >90 | Black | 20/40 min |

3. If you have any questions, please contact me at 277-3272 or anh.pham@edwards.af.mil.

//SIGNED ORIGINAL ON FILE//

ANH PHAM, 2d Lt, USAF, BSC
Chief, Environmental Health Element
Bioenvironmental Engineering

## Attachment 4

## FORECASTED TEMPERATURE MINIMUM FOR WBGT MONITORING

**Figure A4.1. Forecasted Temperature Minimum for Heat Stress Monitoring**

**DEPARTMENT OF THE AIR FORCE**
**HEADQUARTERS 412TH TEST WING (AFMC)**
**EDWARDS AIR FORCE BASE, CALIFORNIA**

23 August 11

MEMORANDUM FOR RECORD

SUBJECT: Forecasted Temperature Minimum for Heat Stress Monitoring

FROM: 412 AMDS/SGPB
55 N. Wolfe Ave.
Edwards AFB, CA 93524-1132

1. Bioenvironmental Engineering Flight (BEF; 412 AMDS/SGPB) conducted a WBGT (wet-bulb globe temperature) heat stress survey when the daily forecasted high temperature was 85ºF. The results obtained from this assessment indicate that measuring the WBGT temperature when the forecasted temperature high is 85ºF is unnecessary due to the low humidity levels in the Edwards AFB area. The low humidity levels keep the Heat Stress flag level at none (White) while it is 85ºF. Therefore, BEF will begin WBGT monitoring when the forecasted temperature high for the day is 95ºF.

2. If you have any questions, please contact me at 277-3272 or anh.pham@edwards.af.mil.

//SIGNED ORIGINAL ON FILE//

ANH PHAM, 2d Lt, USAF, BSC
Chief, Environmental Health Element
Bioenvironmental Engineering